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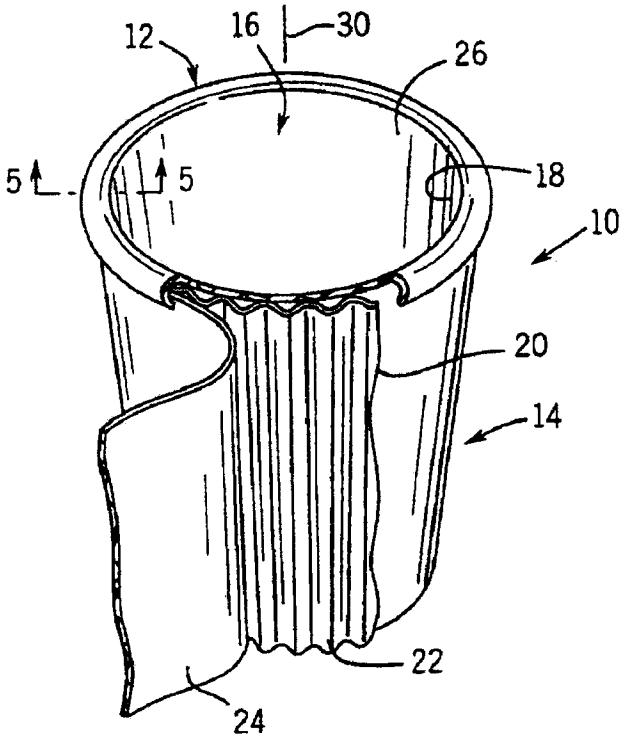
(71) Demandeur/Applicant:
ZADRAVETZ, ROBERT B., US

(72) Inventeur/Inventor:
ZADRAVETZ, ROBERT B., US

(74) Agent: BORDEN LADNER GERVAIS LLP

(54) Titre : METHODE DE FORMATION D'UN CONTENANT AVEC PAROI ONDULEE ET BORD ROULE
(54) Title: METHOD FOR FORMING A CONTAINER WITH CORRUGATED WALL AND ROLLED LIP



(57) Abrégé/Abstract:
A method of forming a paper container uses a three-ply corrugated material having at an outer sheet of paper that may be stretched circumferentially to permit subsequent rolling of the corrugated material about a mandrel and an inner sheet of paper that can be stretched circumferentially to assist in rolling the lip of the cup and/or attaching the bottom to the cup. An extensible paper having two axes of extension of over four percent can be used for one or both of the paper layers.

Abstract

A method of forming a paper container uses a three-ply corrugated material having at an outer sheet of paper that may be stretched circumferentially to permit subsequent rolling of the corrugated material about a mandrel and an inner sheet of paper that can be stretched circumferentially to assist in rolling the lip of the cup and/or attaching the bottom to the cup. An extensible paper having two axes of extension of over four percent can be used for one or both of the paper layers.

METHOD FOR FORMING A CONTAINER WITH CORRUGATED WALL AND ROLLED LIP

FIELD OF THE INVENTION

The invention relates generally to paper containers and in particular to a container having an insulating wall of corrugated paper.

BACKGROUND OF THE INVENTION

Disposable cups for holding hot beverages may be constructed of expanded polystyrene which provides a cup of relatively low cost with walls having good thermal insulation. The insulating properties of the outer walls of the cup allow the cup to be comfortably held despite the high temperature of its contents. The disadvantages of polystyrene are that it is not biodegradable, readily recycled or microwavable.

In contrast, paper cups are both recyclable and biodegradable, but such cups, using a single sheet of paper for their outer walls, provide little thermal insulation. It has therefore been proposed to construct the outer wall of a paper cup of multi-ply corrugated paper material. The air trapped between the flutes of the corrugation and the other plies provides sufficient thermal insulation to allow the cup to be comfortably held. Separately cutting and handling the multiple plies needed to form a multi-ply cup with a corrugated inner layer and assembling the plies into a single corrugated container requires specialized machinery, limiting the commercial feasibility of this approach.

U.S. patent 5,839,653, entitled: "Container with Corrugated Wall" and U.S. patent 6,126,584, entitled: "Method for Forming a Container with Corrugated Wall," assigned to the same assignee as the present invention and hereby incorporated by reference, teach a simplified method of manufacturing a multi-ply cup with a corrugated inner layer by premanufacturing a special corrugated paperboard that can be subsequently rolled into a cup without tearing, greatly simplifying the manufacture of insulated wall cups.

In a first embodiment described in the above patents, the premanufactured corrugated paperboard has an outside layer on one side of fluted center layer made from special paper that may expand to accommodate the distortion inherent in rolling the corrugated board into a cup. The direction of expansion of the paper is horizontal with respect to the normal orientation of the completed cup. The special paper may be creped paper (having small folds that may unfold under tension to provide expansion) or so-called

"extensible Kraft" a specially prepared Kraft paper that stretches slightly under tension and is often used for manufacturing bags for bulk packaged materials such as cement, where the extension can forestall ripping of the bags under stress.

One process capable of producing extensible Kraft paper is described in the "Handbook For Pulp & Paper Technologists" by G. A. Smook, 1982, page 291, herein incorporated by reference. Smook describes at page 291, a Clupak compactor that forcibly shrinks standard Kraft paper along one direction thereby creating an extensible paper. The Clupak compactor consists of a continuous rubber belt moving against a heated, chromium-plated and polished drying cylinder. The web (Kraft) is pressed against the cylinder at the first point of contact by a non-rotating clamping bar. The rubber belt is compacted lengthwise (in the machine direction), which affects the web between it and the cylinder in the same way thus causing compacting and crimping of the fibers in the web longitudinally. The compacting is fixed by drying.

In a second embodiment described in the above patents, the premanufactured corrugated paperboard has an inside layer on one side of fluted center layer made from special paper that may contract to accommodate the distortion inherent in rolling the corrugated board into a cup. The special paper may be creped paper or embossed paper having small or large folds that accommodate compression of the paper. Again, the direction of compression of the paper is horizontal with respect to the normal orientation of the completed cup.

Once the specially manufactured corrugated paperboard is complete, it is formed into a frusto-conical shape and the edges of the corrugated board crimped and/or sealed to aid in the rolling of the upper edge of the cup into a rim and the rolling the lower edge of the cup about a flange extending downward from a cup bottom. The rolling to create the rim and to attach the cup bottom is along an direction perpendicular to the direction of the rolling of the cup body into a frusto-conical shape and vertical with respect to the normal orientation of the cup.

In order that the special corrugated paperboard described in these patents be readily manufactured on standard equipment in which the outer and center plies are fed continuously from rolls, the machine direction of the paper of each ply must be horizontal in the finished cup when the cup is in a normal orientation. Correspondingly, the cross

direction of the paper of the plies of each layer will be vertical in the finished cup when the cup is in a normal orientation

Despite the generally high extensibility of standard paper in the cross direction, small tears can form in the rim of the cup when the cup is formed on standard cup machinery.

SUMMARY OF THE INVENTION

The present inventor has determined that the use of a paper with a high degree of extension in machine direction on the inside of the cup reduces tearing in the rim even though the rim is rolled along the cross direction. This solution appears to work because the dominant factor in tearing is not the stretching the paper in a radial direction about the rim, as one might expect, but the stretching of the paper along the circumference of the rim. Use of an expandable material for the center corrugated layer appears to provide additional benefits in this regard. A combination of an outer creped ply and an inner ply of extensible Kraft appears to be particularly advantageous.

Specifically, the present invention provides a method of manufacturing a paper container using a premanufactured, substantially planar corrugated paperboard with a first outside paper layer providing at least four percent extensibility along a machine direction, and a second outside paper layer providing at least four percent extensibility along a machine direction, each outside paper layer glued respectively face toward face, with aligned machine directions, on either side of a center corrugated paper layer having flutes extending along a vertical direction. A blank is cut from this premanufactured corrugated paperboard and then curved along a circumferential direction crossing the vertical direction and generally aligned with the machine directions of the first and second paper layers. A bottom wall is then attached to a lower curved edge corrugated paperboard blank and an upper edge is curved outward into a lip.

Thus, it is one object of at least one embodiment of the invention to provide a corrugated paperboard for the manufacture of containers that allows for the improved formation of a rolled lip.

It is another object of least one embodiment of the invention to provide an improved corrugated paperboard for the manufacture of containers that can be manufactured with normal corrugation equipment in which plies have aligned machine directions and the flutes must run in the cross direction.

It is yet another object of least one embodiment of the invention to provide a material that can be used on standard cup making equipment while resisting tearing of the lip.

The first outer layer may be creped paper.

Thus it is one object of at least one embodiment of the invention to provide an extensible material particularly suited for a large degree of expansion and appropriate for an outside of a cup.

The second outer layer may be extensible Kraft paper.

Thus, it is one object of at least one embodiment of the invention to provide an inner extensible material appropriate for an inside of a cup where it can be coated to resist saturation by a beverage.

The center corrugated paper layer may also provides at least four percent extensibility along a machine direction aligned with the machine directions of the first outer paper layer and second outer paper layer.

It is an object of at least one embodiment of the invention to provide an extensible intermediate layer between the outer paper plies that is believed to moderate stress between the plies to provide tear resistance.

The center corrugated paper layer may be extensible Kraft paper.

Thus it is one object of at least one embodiment of the invention to an extensible material that can be fluted by standard equipment.

One or more of the paper layers may also provide at least four percent extensibility along a cross direction.

Thus, it is one object of at least one embodiment of the invention to provide addition cross direction extension to promote the rolling of the lip and bottom

The foregoing and other objects and advantages of the invention will appear from the following description. In this description, reference is made to the accompanying drawings which form a part hereof and in which there is shown by way of illustration, a preferred embodiment of the invention. Such embodiment does not necessarily represent the full scope of the invention, however, and reference must be made therefore to the claims for interpreting the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a cup manufactured according to the present invention in partial cut away and showing an outer paper layer peeled away to reveal an inner corrugated layer;

Fig. 2 is a plan view of a blank of corrugated material prior to rolling to form the cup of Fig. 1 showing the direction of the rolling, and a direction of the flutes of the corrugation and showing zones in which the corrugations are flattened for rolling;

Fig. 3 is a cross section through the blank of Fig. 2 in a first embodiment showing a creped outer paper layer;

Fig. 4 is a figure similar to that of Fig. 3 after curvature as is necessary to construct the cup of Fig. 1 and the expansion of the outer layer to permit such curvature;

Fig. 5 is a fragmentary cross section taken along line 5--5 of Fig. 1 showing a forming of the upper lip and attaching of the bottom of the cup;

Fig. 6 is a cross section through Fig. 5 taken along line 6--6 showing the flattening of the corrugated material prior to the forming of Fig. 5;

Fig. 7 is a cross section taken along line 7--7 of Fig. 5 showing the corrugated material without flattening;

Fig. 8 is a detailed view of the corrugated material during rolling to attach to the bottom of the cup showing the slippage between layers permitted by the crushed corrugated layer such as reduces internal shear forces and tearing of the outer layer;

Fig. 9 is a view of slippage of the different lawyers of the corrugated material in a second embodiment of the invention in which a slow setting glue may be used to attach the corrugated elements to one another;

Fig. 10 is a cross section through a cup forming mandrel of a cup manufacturing machine showing a forming of the corrugated material about the mandrel by upwardly moving wings;

Fig. 11 is a cross section similar to Fig. 3 showing a third embodiment with an embossed outer layer;

Fig. 12 is a figure similar to that of Fig. 3 showing a fourth embodiment showing a creped inner paper layer;

Fig. 13 is a figure similar to that of Fig. 4 showing compression of the inner paper layer to permit curvature of the blank;

Fig. 14 is a simplified diagram of a machine for making corrugated paperboard suitable for use with the present invention;

Fig. 15 is a top plan view of a sheet of corrugated paperboard manufactured using the machine of Fig. 14 showing blanks cut there from and the orientation of the machine direction and cross-direction on the blanks; and

Fig. 16 is a cross-sectional view similar to that of Fig. 5 showing the substantial expansion of radius caused by outward flaring of the upper lip superimposed over a fragmentary top plan view of the cup showing the extension caused by the outward flaring and a crack produced in prior art cup designs.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Fig. 1, a cup 10, of the present invention has an upstanding wall 12 rolled into a tube conforming to a frustum of a cone (hereinafter frusto-conical tube) attached at its lower edge 14 to a circular bottom (not shown in Fig. 1) to enclose a beverage receiving volume 16.

The upstanding wall 12 is composed of a corrugated paperboard material having an inside paper layer 18 immediately adjacent to the beverage containing volume 16 which is surrounded by a middle corrugated paper layer 20 having vertically extending flutes 22. This, corrugated paper layer is in turn, surrounded by an outside paper layer 24 which sandwiches the middle corrugated paper layer 20 between itself and the inside paper layer 18. An adhesive (not shown) connects the middle corrugated paper layer 20 to the inside paper layer 18 and the outside paper layer 24 according to methods well known in the art. The inside paper layer 18 is coated with a thin water resistant coating 26 to provide protection of the inside paper layer 18 from hot liquid that may be held within the volume 16. In the preferred embodiment, the coating 26 is a pulpable acrylic permitting the cup to be easily recycled. Such coatings are well known in the art and include a variety of moisture resistant materials including wax and acrylics.

Referring now to Fig. 4, the upstanding wall 12, before it is rolled into a cup as shown in Fig. 1, is formed from a blank 28 cut from a premanufactured corrugated paperboard of corrugated material into a sector of an annulus thereby to roll into the frusto-conical shape of Fig. 1. The flutes of the corrugations lie generally along a vertical direction 30 extending along a line of radius of the annulus whereas the bending of the

blank 28 into the frusto-conical shape is along a circumferential direction 32 crossing the vertical direction 30.

Referring now to Fig. 3, in a first embodiment, the outside paper layer 24 of the corrugated blank 28 is constructed of an extensible paper that will lengthen under tension along the circumferential direction 32. Such paper may be a creped paper having multiple randomly formed creases and folds that under tension straighten to allow the outside paper layer 24 to expand as described. Alternatively, in a second embodiment (not shown) the outside paper layer 24 may be a so-called extensible Kraft paper which provides a stretching at the fiber level of the paper. Extensible Kraft is commercially available under the trade name of XKL extensible from Thilmany Pulp and Paper Company of Kaukauna, Wisconsin. Referring to Fig. 11, in a third embodiment, the outside paper layer 24 may also be a paper with embossing 25, where the embossing 25 may flatten when the paper is put under tension allowing the paper to lengthen. Other extensible materials may also be used as will be apparent from this description to those of ordinary skill in the art.

Referring now to Fig. 4, when the blank 28 is rolled as indicated by arrows 34 into a frusto-conical shape, the outside paper layer 24 may expand along the circumferential direction 32 to permit the rolling without tearing of the outside paper layer 24 or a crushing of the flutes of the middle corrugated paper layer 20. The expansion of the outside paper layer 24 is necessary because of the substantially greater thickness of the blank 28 than a single sheet of paper normally used for the upstanding wall 12 of a cup. This greater thickness of wall material displaces the outside paper layer 24 to a greater radius than the inside paper layer 18 requiring a significant increase in the circumferential length of the outside paper layer 24. An expansion of the outside paper layer 24 of two to fifteen percent is believed to be adequate for most standard container sizes with necessary thickness of the corrugated material.

Referring now to Figs. 12 and 13, in a fourth embodiment, the inner layer 18 may be a creped or embossed paper. When the blank 28 is rolled as indicated by arrows 34 into a frusto-conical shape, the inside paper layer 18 may compress along the circumferential direction 32' to permit the rolling without tearing of the outside paper layer 24 or a crushing of the flutes of the middle corrugated paper layer 20. In this embodiment, the compression of the inside paper layer 18, rather than an expansion of the outside paper layer 24 accommodates the difference in circumferences of the inside paper layer 18 and

outside paper layer 24 as the blank 28 is rolled. Again, a compression of the inside paper layer 18 of two to fifteen percent is believed to be adequate for most standard container sizes with necessary thickness of the corrugated material.

The ability of the paper layers to change circumferential dimension, either by expansion or compression, as the cup is rolled by the requisite amount will be termed circumferential plasticity. It will be recognized that both the inner and outer paper layers may be constructed of paper exhibiting circumferential plasticity and in this case the amount of plasticity for each layer may be reduced from that required when only a single layer having circumferential plasticity is used.

Referring again to Fig. 2, prior to folding the blank 28 and assembling it into a cup 10, the flutes 22 (not shown in Fig. 2) are crushed flat in a strip along the lower edge 14 and upper edge 38 of the blank 28. This flattening reduces the thickness of the middle corrugated paper layer 20 (as shown in Fig. 6) prior to it being folded into a cup and can be performed in a single operation during the die cutting of the blank by including anvils within the knife blade of the die to flatten the edges 14 and 38. Similarly, the flutes 22 are crushed flat in strips along the left and right edges 46 and 44 to permit sealing these edges together as will be described.

Referring now to Fig. 10, the blank 28 is folded about a frusto-conical mandrel 40 by conforming wings 42 in a cup making machine well known in the art. When the folding is complete, left and right edges 44 and 46 of the blank 28 abut and are sealed together by a heat-sealing process or adhesive such as is well known in the art.

Next, and referring to Fig. 5, the crushed upper edge 38 of the upstanding wall 12 is rolled outward to form a lip 48 according to conventional paper cup construction techniques. Also the lower edge 14 is rolled about a downward extending lip on the periphery of the disked shaped bottom 51 to form a seal 49 against leakage of the contained beverage. The seal 49 is formed by heat sealing the lower edge 14 to the bottom 51 or attaching it with adhesive.

Referring to Fig. 6, the crushing of the upper and lower edges 14 and 38 reduces the difference in radius between the inside paper layer 18 and the outside paper layer 24 in the folding of the lip 48 and the bottom seal 49 thus reducing the difference in the circumference of these two layers at the lip 48 and the seal 49 and the tendency of the outside paper layer 24 in the seal 49 and the inside paper layer 18 in the lip 48 to tear.

With respect to the seal 49, the extensible material of the outside paper layer 24 may also expand along the vertical direction 30 further reducing this tendency of the outside paper layer 24 to tear upon stretching.

Although the inventor does not wish to be bound by a particular theory, it is believed that, in both the cases of the lip 48 and the seal 49, the crushed middle corrugated paper layer 20 facilitates a displacement, upon rolling, between the layers 18 and 24. Referring to Fig. 8, by permitting a degree of displacement between layers 18 and 24 in the seal 49, the stretching of the outside paper layer 24 necessary for the folding operation is reduced. A similar effect occurs with respect to the opposite direction rolling of the lip 48.

Referring to Fig. 7, because the crushing of the upper edge 38 and lower edge 14 is restricted to the region of the lip 48 and seal 49, the thermal properties of the majority of the outer surface of the upstanding wall 12 are preserved, in particular, the air spaces between the middle corrugated paper layer 20 and the layers 18 and 24.

In another embodiment of the invention, shown generally in Fig. 9, this same principle of permitting a sliding between the inside paper layer 18 and outside paper layer 24 may be invoked to permit the forming of the blank 28 around the mandrel 40 with a reduced or minimal need for expansion of the outside paper layer 24. In this embodiment, a slow setting adhesive 50 is used to assemble the components of the blank 28 together. In particular, the opposed surfaces of layer 18 and layer 24 are coated with a slow setting adhesive 50 and the blank 28 is rolled about the mandrel 40. At the time that the wings 42 form the blank 28 around the mandrel 40, the variation between the circumference necessary from the inside paper layer 18 and outside paper layer 24 is accommodated by relative slippage shown by arrows 52 between the middle corrugated paper layer 20 and the inside paper layer 18 and the middle corrugated paper layer 20 and the outside paper layer 24. A misalignment in the left and right edges 44 and 46 of the inside paper layer 18 and outside paper layer 24, respectively, at a point of seaming, is relatively minor and may be accommodated by crushing and heat sealing all layers 18 and 24 of both edges 44 and 46 together at the seam line. Alternatively, the outside paper layer 24 of the blank may be cut to be larger than the inside paper layer 18 and the middle corrugated paper layer 20. The slight loss in thermal resistance at this seam caused by the crushing out of the air

space between the layers is offset by the seam which comprises six layers of paper material.

Adhesives 50 suitable for this purpose and the control of the setting time of the adhesives are well understood in the art.

Normally moisture protection is required for the outside paper layer 24 when the cup will be used for cold beverages as a result of condensation forming on the outer surfaces. However, in the present cup, the thermal insulating properties of the corrugated blank greatly reduces such condensation. Nevertheless, the outer surface of outside paper layer 24 may also be coated with a water resistant material.

Referring now to Fig. 14, practical commercial construction of the blanks 28 may be performed on a commercial corrugation machine 58 providing for multiple feeder rolls 60 providing paper for the inside paper layer 18, the middle corrugated paper layer 20, and the outside paper layer 24.

Each paper layer 18, 20, and 24 will have aligned machine directions 62 being the direction from which the materials of the paper layers 18, 20, and 24 are removed from the rolls 60 and reflecting the fabrication of the paper layers 18, 20, and 24 using conventional papermaking machines. As will be understood in the art, the machine direction 62 generally defines a direction in which the fibers in the paper are aligned and strongly affects the ability to stretch the paper. Normal papers provide one to three percent stretch in the machine direction and three to five percent stretch in the cross-direction perpendicular to the machine direction.

Paper removed from roll 60 holding middle corrugated paper layer 20 is received by corrugating rollers 64 which provide for fluting extending along the cross-direction. Paper removed from rolls 60 holding paper layers 18 and 24 are received by adhesive application rollers 66 that apply adhesive to the inner surfaces of the paper layers 18 and 24 which are then adhered to the opposite sides of middle corrugated paper layer 20 as they pass through combiner rollers 68. The completed paperboard 29 may then be cut into blanks 28 as has been described above by a die cutter 70.

Referring now to Fig. 15, the vertical direction 30 for each blank 28, as previously described, is aligned with the cross-direction 72 of the paper layers and the circumferential direction 32 associated with each blank 28 is aligned with the machine direction 62 of the paper layers. As noted above, with conventional paper, the machine direction 62 will offer

a relatively low extensibility, however, per the present invention, a much greater extensibility is provided in the outer sheets by using a creping or extensible Kraft.

Referring now to Fig. 16, a conventional cup-forming machine, operating on the blanks 28 can produce small tears 74 in the lip 48 extending generally around the circumference of the cup. While the present inventor does not wish to be bound by a particular theory, it is believed that these tears 74 are caused by the outward rolling of the lip 48 such as requires a substantial circumferential extension 84 of the inner layer 18 as the radius of the upstanding wall 12 increases at the lip 48 by distance 80.

Accordingly in the present invention, the inside paper layer 18 may be constructed from an extensible Kraft having a substantially greater machine direction extension than that found in normal paper. Preferably, the extensible Kraft provides a machine direction extension greater than the three percent stretch found in standard paper and greater than the four percent stretch normally found in the cross-direction of such paper. Suitable paper may be obtained from Thilmany under the trade name XKL as has been described above and provides greater than five percent extension in both the cross and machine directions and typically extension values ranging from six to twelve percent.

Additional resistance against tears 74 may be obtained by also making the middle corrugated paper layer 20 as shown in Fig. 15 from a similar extensible Kraft. The ability of these inner layers to expand appears to accommodate the rolling process with reduced tears possibly by providing better transition between the distortions of the materials.

The above description has been that of a preferred embodiment of the present invention. It will occur to those that practice the art that many modifications may be made without departing from the spirit and scope of the invention. In order to apprise the public of the various embodiments that may fall within the scope of the invention, the following claims are made:

CLAIMS:

1. A method of manufacturing a paper container comprising the steps of:

(a) premanufacturing a substantially planar corrugated paperboard with an outside paper layer providing at least four percent extensibility along a machine direction of the paper layer, an inside paper layer providing at least four percent extensibility along a machine direction of the paper layer, each outside paper layer glued respectively face toward face, with aligned machine directions, on either side of a middle corrugated paper layer having flutes extending along a vertical direction to laminate the center corrugated paper layer between the first outside paper layer and the second outside paper layer;

(b) cutting a blank from the premanufactured corrugated paperboard;

(c) curving the cut blank of corrugated paperboard along a circumferential direction crossing the vertical direction and generally aligned with the machine directions of the outside and inside paper layers so that the outside paper layer is on the outside of the curve; and

(d) attaching a bottom wall to a lower curved edge of the curved and cut corrugated paperboard blank; and

(e) rolling an upper curved edge outward into a lip on the cut and curved corrugated paperboard blank.

2. The method of claim 1 wherein the outside layer is creped paper.

3. The method of claim 1 wherein the inside layer is extensible Kraft paper.

4. The method of claim 1 wherein the middle corrugated paper layer provides greater than four percent extensibility along a machine direction of the middle corrugated paper layer as aligned with the machine directions of the outside paper layer and inside paper layer.

5. The method of claim 4 wherein the middle corrugated paper layer is extensible Kraft paper.

6. The method of claim 5 wherein the middle corrugated paper layer also provides at least four percent extensibility along a cross direction.

7. The method of claim 1 the inside paper layer further provides at least four percent extensibility along a cross direction of the inside paper layer perpendicular to the machine direction.

8. The method of claim 1 the inside paper layer further providing at least five percent extensibility along the machine direction.

9. The method of claim 1 including the step of:

crushing the upper curved edge of the corrugated paper board so that the corrugated paper layer is flattened before rolling the upper curved edge into a lip.

10. A paper container comprising:

an outside paper layer of creped paper, the creped paper oriented to provide extension circumferentially around the container;

an inside paper layer of extensible Kraft, the extensible Kraft having a machine direction oriented circumferentially around the container;

a middle corrugated paper layer having flutes extending from end to end of the container as laminated between the outside paper layer and the inside paper layer to form a container wall;

a bottom attached to a lower edge of the container wall; and

a lip rolled outward in an upper edge of the container wall.

11. The container of claim 10 wherein the container wall is frusto-conical.

12. The container of claim 10 wherein the outside paper layer is creped paper.

13. The container of claim 10 wherein the inside paper layer is extensible Kraft paper.

14. The container of claim 10 wherein the middle corrugated paper layer provides greater than four percent extensibility along a machine direction of the middle corrugated paper layer as aligned with the machine directions of the outside paper layer and inside paper layer.

15. The container of claim 14 wherein the middle corrugated paper layer is extensible Kraft paper.

16. The container of claim 14 wherein the middle corrugated paper layer also provides at least four percent extensibility along a cross direction.

17. The container of claim 10 the inside paper layer further provides at least four percent extensibility along a cross direction of the inside paper layer perpendicular to the machine direction

18. The container of claim 10 the inside paper layer further providing at least six percent extensibility along the machine direction.

19. The container of claim 10 including the step of:

crushing the upper curved edge of the corrugated paper board so that the corrugated paper layer is flattened before rolling the upper curved edge into a lip.

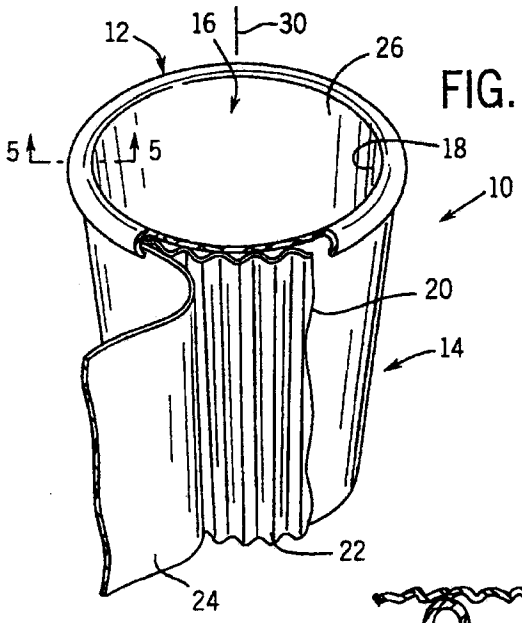


FIG. 1

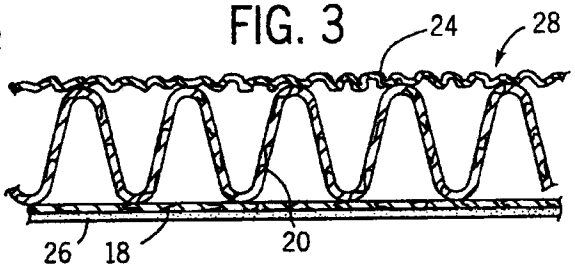


FIG. 3

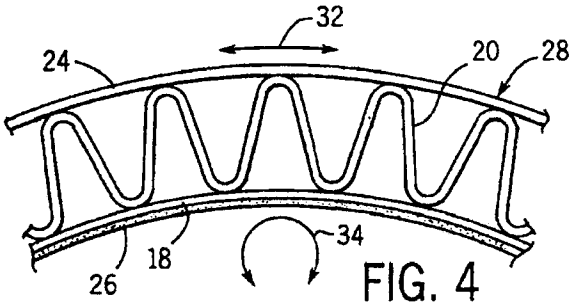


FIG. 4

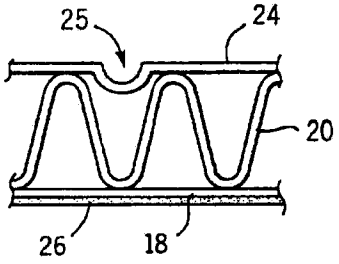


FIG. 11

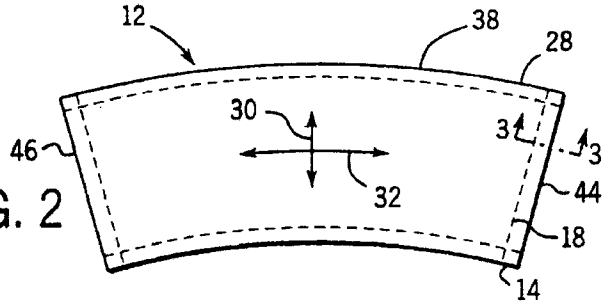


FIG. 2

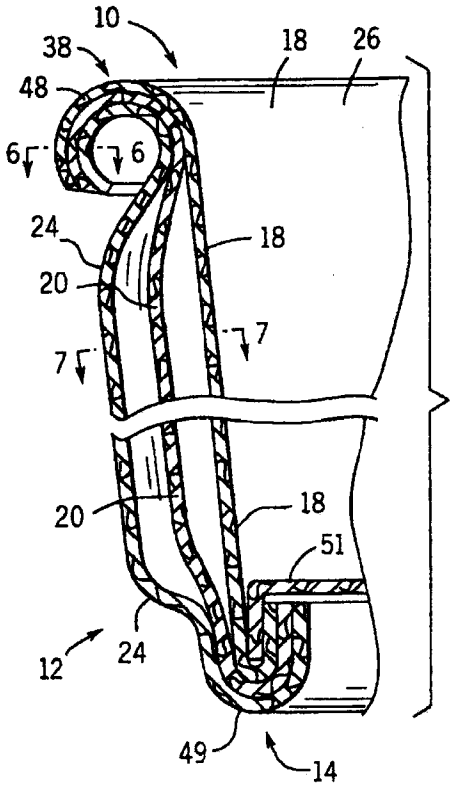


FIG. 5

FIG. 6

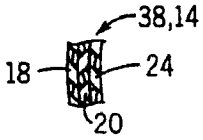


FIG. 7

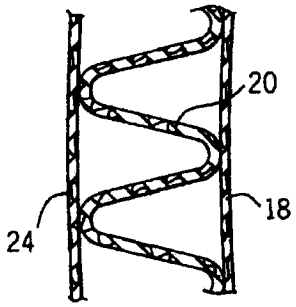
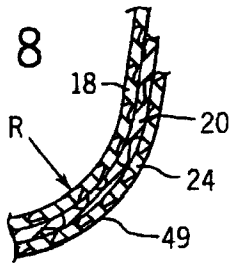


FIG. 8



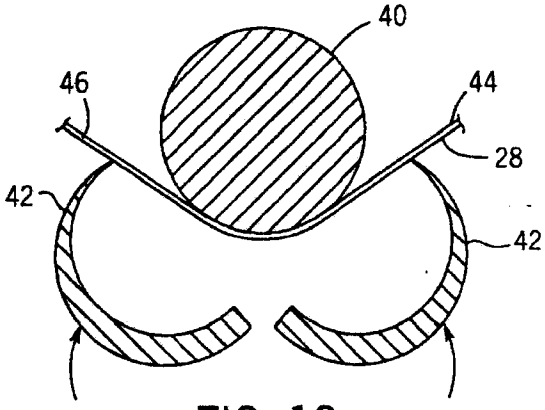


FIG. 10

FIG. 9

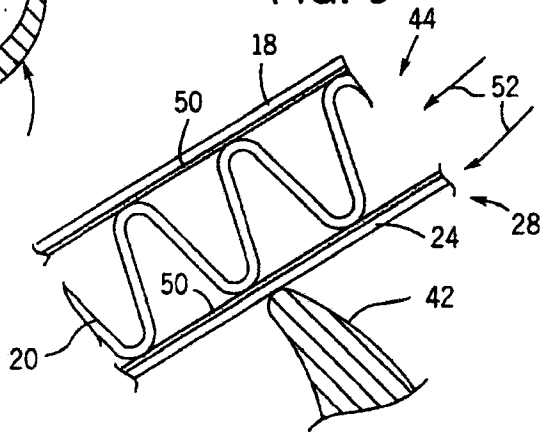


FIG. 12

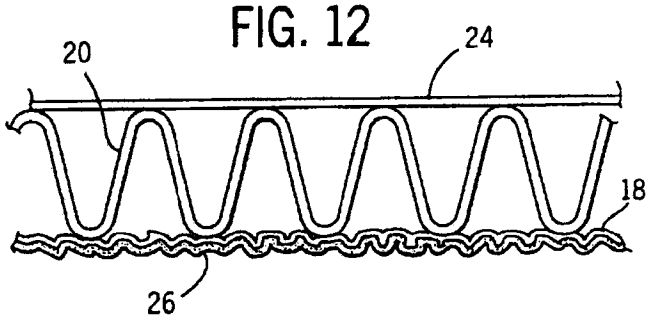
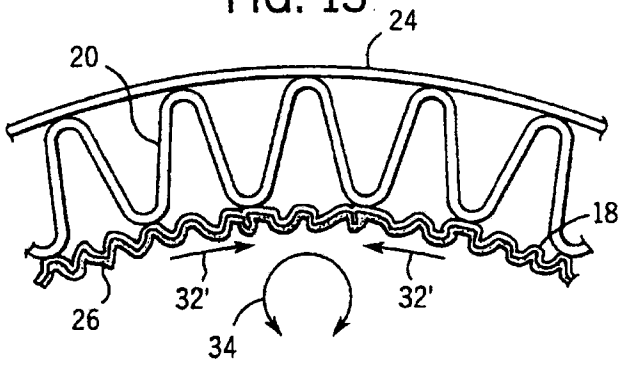


FIG. 13



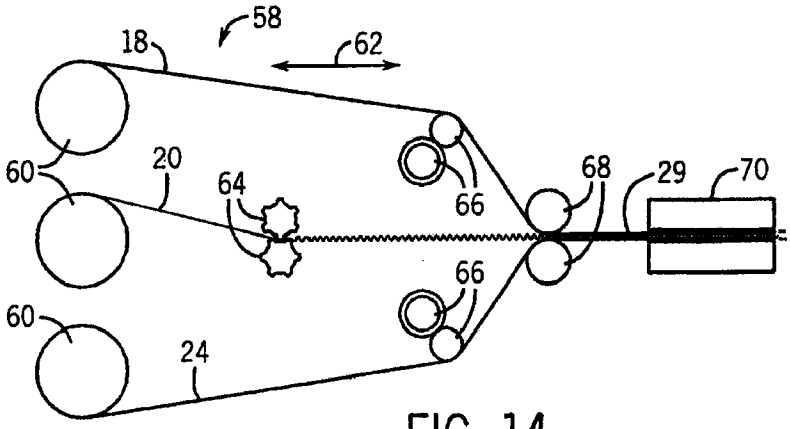


FIG. 14

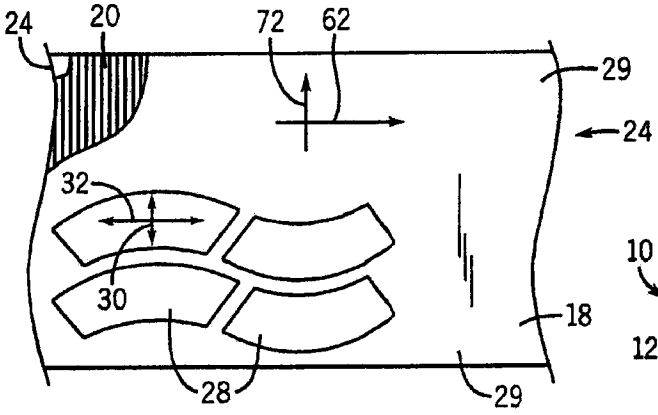


FIG. 15

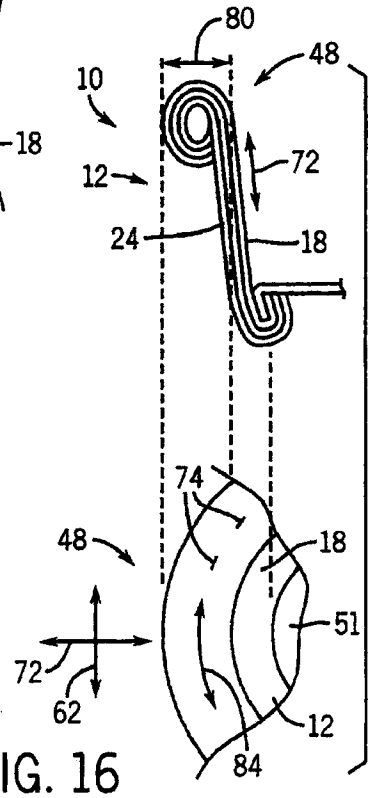


FIG. 16